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BIOTIC ASSESSMENT OF PAINTED ROBE CREEK, STILLWATER AND GOLDEN VALLEY COUNTIES, MONTANA

JUNE 1999

report to
The Montana Department of Environmental Quality
Helena, Montana

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bioassessment metrics have not yet been examined thoroughly enough to determine whether or not the individual metrics or their integrated scores can discriminate impaired conditions from good biotic health. Thus, the conclusions in this report concerning bioassessment based upon these metrics must be regarded as tentative.

Habitat assessment enhances the interpretation of biological data (Barbour and Stribling 1991), because there is generally a direct response of the biological community to habitat degradation in the absence of water quality impairment. If biotic health appears more damaged than the habitat quality would predict, water pollution by quantities of organic materials, nutrients, metals, or other toxicants might be suspected. On the other hand, an "artificial" elevation of biotic condition in the presence of habitat degradation may be due to the paradoxical effect of mild nutrient or organic enrichment. Habitat assessment data is even more important in the Plains ecoregions, where the relationships between habitat variables and benthic community characteristics remain largely unknown.

METHODS

Aquatic macroinvertebrates were sampled by Warren Kellogg of the Natural Resources Conservation Service from four sites on Painted Robe Creek on June 10 and 11, 1999. Sampling site designations and locations are listed in Table 1. Tables and figures throughout this report list sites in an upstream-to-downstream order.

Table 1. Sampling sites, dates and locations. Sites are listed in upstream-to-downstream order. Painted Robe Creek, June 10 and 11, 1999.

Site	Location description	Latitude/Longitude
PR 1-3	Lehfeldt site	46° 06'18"/ 109° 09' 56"
PR 2-1	Painted Robe Road crossing (Paulson)	46° 10' 53.8"/ 108° 59'14.8"
PR 2-3	Buffalo Highway crossing – upstream 150 yds.	46° 13' 6.4"/ 108° 53' 2.9"
PR 2-14	~200 yds. upstream from Musselshell River	46° 16' 21"/ 108° 49' 34"

In addition to macroinvertebrate sample collection, habitat quality was visually evaluated at three sites and reported by means of the habitat assessment protocols recommended by Bukantis (1998) for streams with prevalent glides and pools. Macroinvertebrate samples and associated habitat data were delivered to Rhithron Biological Associates, Missoula, Montana for laboratory and data analyses.

In the laboratory, the RBP III sorting method was used to obtain subsamples of approximately 300 organisms from each sample. Organisms were identified to the lowest practical level. Community structure, function, and sensitivity to impact were characterized for each subsample using a battery of ten attributes, or metrics, recommended by Bukantis (1998) for streams of the Plains ecoregions. Two bioassessment methods were employed to evaluate the community attributes. Each method employed a reference condition against which the Painted Robe Creek data were compared. First, an ecoregion reference was used: metric results were compared to reference criteria provisionally established by Montana DEQ for streams of the Plains ecoregions. Actual metric values from each sample were compared to ecoregional reference values to obtain scores. Scores for all metrics were combined, and a total bioassessment score was expressed as a percentage of the maximum possible score. Total bioassessment scores were interpreted in terms of aquatic life or other uses according to guidelines established by Montana DEQ (Bukantis 1998) and elaborated in Table 4 in this report.

RESULTS

Habitat Assessment

Table 2 shows the habitat parameters evaluated, parameter scores and overall habitat evaluations for the four sites studied. Figure 1 graphically compares total habitat assessment scores for the three sites.

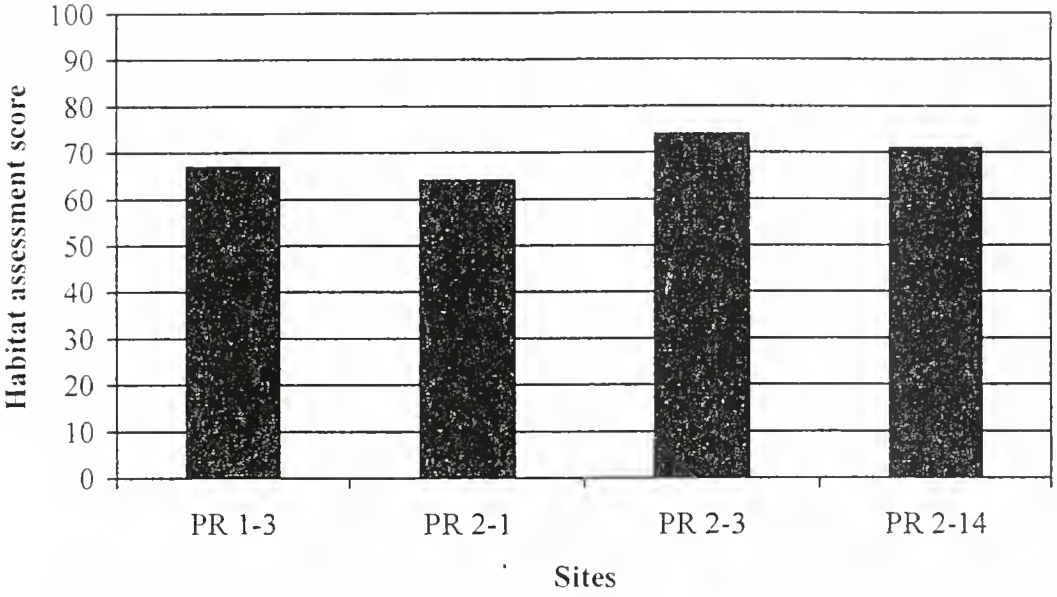
Table 2. Stream and riparian habitat assessment, glide/pool prevalence: Painted Robe Creek. June. 1999.

Maximum possible score	Sites:	PR 1-3	PR 2-1	PR 2-3	PR 2-14
	Parameters:				
20	Bottom substrate, cover	15	11	11	8
20	Pool substrate character	15	6	15	14
20	Pool variability	5	13	16	16
20	Channel alteration	11	11	17	18
20	Sediment deposition	18	16	16	13
20	Channel sinuosity	14	11	9	8
20	Channel flow status	15	15	12	14
10 / 10	Bank vegetation protection (left/right)	5 / 7	8 / 8	10 / 10	10 / 8
10 / 10	Bank stability (left/right)	8 / 8	8 / 8	9 / 9	9 / 9
180	TOTAL:	121	115	134	127
PERCENT OF MAXIMUM:		67	64	74	71
CONDITION[1]		SUB-OPTIMAL	SUB-OPTIMAL	SUB-OPTIMAL	SUB-OPTIMAL

[1]Optimal >81%, Sub-Optimal 75-56%, Marginal 49-29%, Poor <23%. From Plafkin et al. 1989.

Habitat quality was not perceived to differ much among the sampled reaches of Painted Robe Creek. However, there were some upstream-to-downstream patterns apparent in several of the evaluated parameters. Benthic substrate and available cover diminished from sub-optimal condition at the uppermost site with diverse habitats noted there, to marginal condition at Site 2-14. Benthic substrate appears to have become more and more monotonous in the downstream sites. Growths of filamentous algae were reported to cover 40-60% of the substrate at Site 2-3, and heavy algal mats with silt trapping were noted at the lowermost site, 2-14. Sediment deposition affected less than 20% of the stream bottom at Site 1-3, but up to 50% of the bottom was affected at Site 2-14. Sites 2-1 and 2-3 were thought to be protected by sediment reservoirs in the form of beaver dams or irrigation reservoirs, but near the Musselshell River, filamentous algae

Figure 1. Total habitat assessment scores for four sites on Painted Robe Creek. June 1999. Scores are reported as the percent of maximum possible score.



trapped fine sediments. Gravel substrates were observed to underlie the muddy algal mats.

Channel sinuosity declined in a downstream direction, from sub-optimal conditions at the uppermost site to marginal conditions near the mouth. Channel alteration was reported to decrease progressively from Site 1-3 to Site 2-14, suggesting that the change in sinuosity may have been due to natural geographic or geologic factors rather than to human interventions.

Protection of streambanks by vegetation and overall streambank stability appeared to improve from upstream sites to downstream sites. Vegetative protection was rated sub-optimal to marginal at Site 1-3, but was optimal or sub-optimal at all other sites. Bank stability was not perceived to be a remarkable problem at any sampled site. Channel flow status was reported to be sub-optimal at all sites, however, impoundments and irrigation were reported to cause cessation of flow at site 2-3 later in the summer.

Bioassessment

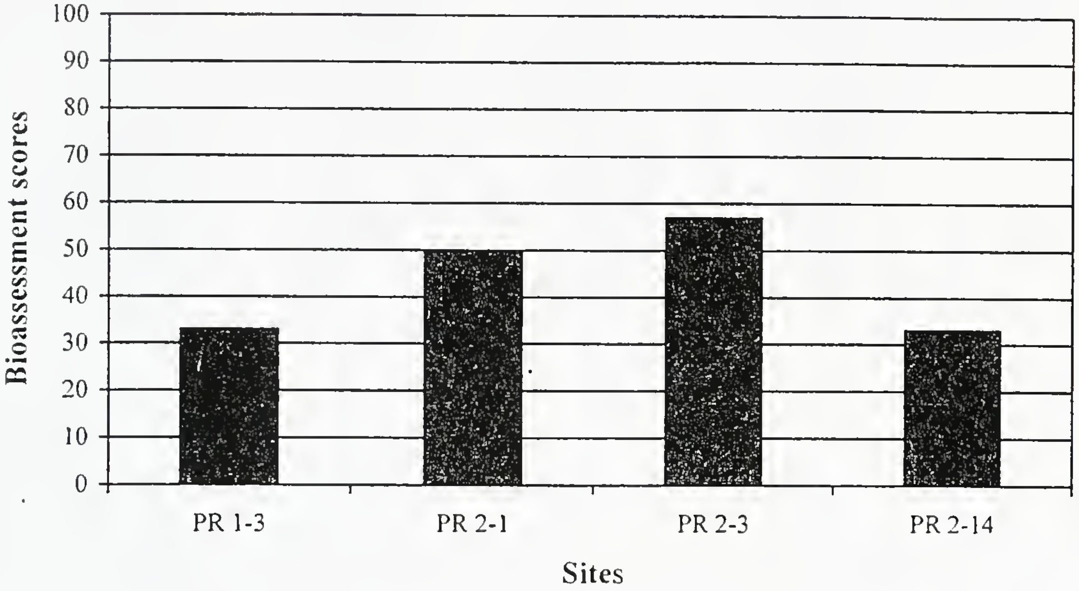
Macroinvertebrate taxa lists, metric results and other information for each sample are given in the Appendix.

The Montana Plains ecoregions reference

Figure 2 compares the total bioassessment scores for all four Painted Robe Creek sites when the macroinvertebrate data was evaluated using the Montana DEQ Plains ecoregions reference and metric battery, which are considered provisional. It is important to note that neither the metric battery used here nor any of its components has been tested for discriminatory power, accuracy, or precision in Plains ecoregions streams.

Table 3 summarizes the metric battery used in the Plains ecoregional reference method, and Table 4 shows the Montana DEQ criteria for assignment of use-support categories. Breakdown of scores for each metric calculated from the Painted Robe Creek macroinvertebrate samples is presented in Table 5.

Figure 2. Total bioassessment scores compared among Painted Robe Creek sites. June 1999. Montana DEQ Plains ecoregions reference criteria were used to determine scores. Scores are reported as the percent of maximum possible score.



Partial support of designated uses was indicated by bioassessment scores at all four sites sampled on Painted Robe Creek. Scores suggest that biotic health was moderately impaired in all sampled reaches. The highest bioassessment score was calculated for site 2-3, which was the site that also attained the highest habitat assessment score. For all four sites, scores ranged from 33% of maximum to 57% of maximum.

Table 3. Provisional metrics and scoring criteria for the Montana Plains ecoregions. (Bukantis, 1998).

	Scoring Criteria			
metric	3	2	1	0
Taxa richness	>24	24 - 18	18 - 12	<12
EPT richness	>8	8 - 6	5 - 3	<3
Biotic index	<5	5 - 6	6 - 7	>7
% dominant taxon	<30	30 - 45	45 - 60	>60
% collector (gatherers + filterers)	<60	60 - 80	80 - 95	>95
% EPT	>50	50 - 30	30 - 10	<10
Shannon diversity	>3.0	3.0 – 2.4	2.4 – 1.8	<1.8
% scrapers + shredders	>30	30 - 15	15 - 3	<3
Predator taxa richness	>5	4 - 5	3 - 4	<3
% multivoltine	<40	40 - 60	60 - 80	>80

Table 4. Criteria for the assignment of support classifications / standards violation thresholds (Bukantis, 1998)

% Comparability to reference	**Use support**
>75	Full support--standards not violated
25-75	Partial support--moderate impairment--standards violated
<25	Non-support--severe impairment--standards violated

Table 5. Metric values, percent of ecoregional reference, and bioassessments for Painted Robe Creek, June 1999.

Metric	PR 1-3	PR 2-1	PR 2-3	PR 2-14
Taxa richness	20	27	24	22
EPT richness	1	1	1	1
Biotic index	5.61	6.74	8.01	7.66
% Dominant taxon	55	38	28	50
% Collectors	26	89	53	82
% EPT	<1	1	10	1
Shannon H	2.09	2.54	2.90	2.80
% Scrapers plus shredders	<1	<1	<1	0
# Predator taxa	1	7	9	6
% Multivoltine	63	35	31	63

Metric score				
Taxa richness	2	3	2	2
EPT richness	0	0	0	0
Biotic index	2	1	0	0
% Dominant taxon	1	2	3	1
% Collectors	3	1	3	1
% EPT	0	0	1	0
Shannon H	1	2	2	2
% Scrapers plus shredders	0	0	0	0
# Predator taxa	0	3	3	3
% Multivoltine	1	3	3	1
Total score (maximum = 30)	10	15	17	10
Percent of maximum	33	50	57	33
Use support *	**Partial support**	**Partial support**	**Partial support**	**Partial support**

*See Table 4.

Macroinvertebrate communities

Benthic assemblages of Painted Robe Creek were generally comprised of midges and other flies, with beetles, damselflies and non-insect taxa abundant at most sites and dominant at some. This fauna is common to the warm-water, slow-flowing, soft-bottom streams of parts of the Montana plains ecoregions.

Biotic index scores calculated for benthic assemblages sampled in this study ranged from 5.61 to 8.01. High biotic index scores at site 2-3 (8.01) and site 2-14 (7.66) suggest that water quality impairs the integrity of the macroinvertebrate assemblages in these reaches of Painted Robe Creek. It is interesting to note that ranked biotic index values correlate with ranked measures of total dissolved solids. Measured dissolved solids at sites 2-3 and 2-14 were 7730 mg/L and 3360 mg/L respectively. Biotic index scores of 5.61 and 6.74 were calculated for benthic communities at sites 1-3 and 2-1 respectively, where dissolved solids measured 1150 mg/L and 2510 mg/L. Abundances of taxa tolerant of salinity also correlated with dissolved solids at Painted Robe Creek sites. Larva of the damselfly *Enallagma/Ischnura* dominated (28% of sampled organisms) the benthic assemblage at site 2-3 and comprised more than 7% of organisms at site 2-14. The mayfly *Caenis* sp. was also abundant (10% of sampled organisms) at site 2-3. Neither organism occurred in the sample taken at site 1-3, and neither was abundant (combined abundance <2%) at site 2-1.

Low dissolved oxygen, warm water conditions, and muddy substrates appear to be the predominant milieu at the two uppermost sites (1-3 and 2-1). At site 2-1 this is suggested by the overwhelming dominance of free-living nematodes in the benthic sample. These and other non-insect taxa comprised 65% of the sampled assemblage. Biting midges in the dipteran family Ceratopogonidae were also very abundant (26% of the sampled assemblage).

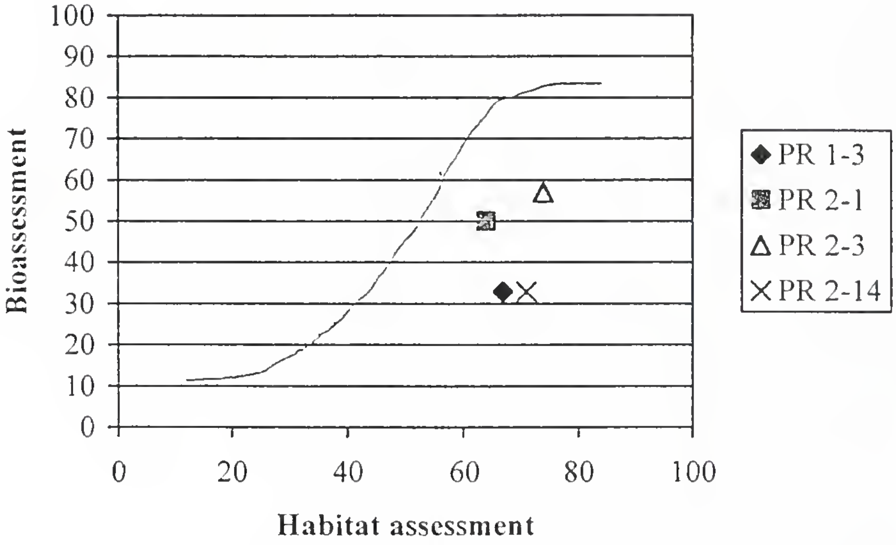
The two lower sites produced an abundance of midges with tolerance to low dissolved oxygen conditions. These include *Chironomus* sp. and *Dicrotendipes* sp., both of which are hemoglobin-bearing animals. In addition, other highly-tolerant creatures were collected at both sites, including the midge *Procladius* sp. and the amphipod *Hyallela azteca*. The presence of these taxa suggests that organic and/or nutrient pollution may further compromise biotic health in the lower reaches of Painted Robe Creek.

Near-lentic conditions at site 2-14 are suggested by the dominance of cladocerans in the sample taken there; they comprised more than 50% of the organisms collected at this site. An unusual find was the midge *Acalcarella* sp., suggesting that sandy substrates were present over at least part of the sampled area.

Scraping organisms were rare in samples, suggesting that stable, hard substrates were also rare. Only a single shredder was collected from Painted Robe Creek, this was an individual caddisfly, *Lepidostoma* sp., which occurred in the sample from the uppermost site. Inputs of leaves and woody debris may be limited, or instream retention of these may be compromised by flow conditions or by impoundments. Information about the riparian vegetation zone was not included in habitat assessments. A general dearth of clinger taxa in these reaches of Painted Robe Creek correlates well with the field observations of heavy filamentous algae growths or muddy bottoms at all sampling sites.

The relationship between habitat assessment scores and bioassessment scores, bearing in mind the probable limitations of the current bioassessment metric battery, suggest that water quality was a limiting factor to the biotic health of benthic communities in Painted Robe Creek. Figure 3 illustrates this. High habitat scores in relation to the bioassessment scores result in a cluster of data points lying below a line describing the expected relationship between habitat and biotic health when water quality is unimpaired. The mechanism for water quality impairment in Painted Robe Creek appears to be organic and/or nutrient enrichment, and, in the lower reaches, salinity.

Figure 3. Total bioassessment scores (Plains ecoregions reference) plotted against habitat assessment scores for four sites on Red Robe Creek, June 1999. The red line describes the hypothetical relationship expected when water quality is good and biotic health is determined predominantly by habitat quality (Barbour and Stribling 1991).



CONCLUSIONS

- Salinity appears to impair water quality and biotic health at the downstream sites, 2-3 and 2-14. This hypothesis is suggested by high levels of total dissolved solids, high biotic index scores, and abundances of taxa specifically tolerant of saline conditions.
- The taxonomic composition of benthic assemblages suggest that warm water conditions, muddy substrates, and low dissolved oxygen levels are the predominant characteristics of Painted Robe Creek in the sampled reaches.

LITERATURE CITED

Barbour, M.T. and J.B. Stribling. 1991. Use of habitat assessment in evaluating the biological integrity of stream communities. In: *Biological Criteria: Research and Regulation.* EPA-440-5-91-005. U. S. Environmental Protection Agency, Office of Water, Washington, D.C.

Barbour, M.T., J.B Stribling, and J.R. Karr. 1995. Multimetric approach for establishing biocriteria and measuring biological condition. Pages 63-77 *in* W.S. Davis and T.P. Simon (editors) *Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making.* Lewis Publishers, Boca Raton.

Bollman, W. 1998. Improving Stream Bioassessment Methods for the Montana Valleys and Foothill Prairies Ecoregion. Master's Thesis. University of Montana.

Bukantis, Bob. 1998. Rapid bioassessment macroinvertebrate protocols: sampling and sample analysis SOP's. Montana Department of Environmental Quality. Water Quality Division. Working draft.

Fore, L. S., J.R. Karr and L.L. Conquest. 1994. Statistical properties of an index of biotic integrity used to evaluate water resources. Canadian Journal of Fisheries and Aquatic Sciences. 51:1077-1087.

Hynes, HBN. 1970. *The Ecology of Running Waters.* University of Toronto Press.

Karr, J.R. and D.R. Dudley. 1981. Ecological perspective on water quality goals. Environmental Management 11:249-256.

Plafkin, J.L., M.T. Barbour, K.D. Porter and S.K. Gross. 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers. Benthic Macroinvertebrates and Fish. U.S. EPA. 444/ 4-89-001.

APPENDIX

Macroinvertebrate taxonomic and metric data, Painted Robe Creek, June 1999.

Aquatic Macroinvertebrate Taxonomic Data

Site Name: Painted Robe Creek: Lehfeldt site
Site ID: PR 1-3

Approx. percent of sample used: 7

Taxon	Quantity	Percent	HBI	FFG
Nematoda	173	55.27	5	PA
Enchytraeidae	1	0.32	10	CG
Tubificidae - immature	4	1.28	9	CG
Sphaeriidae	14	4.47	8	CG
Lymnaeidae	1	0.32	6	CG
Physella sp.	2	0.64	8	CG
Copepoda	3	0.96	8	CG
Ostracoda	1	0.32	8	CG
Acari	5	1.60	5	PA
Total Misc. Taxa	**204**	**65.18**		
Lepidostoma sp.-early instar	1	0.32	1	SH
Total Trichoptera	**1**	**0.32**		
Optioservus sp.	1	0.32	4	SC
Total Coleoptera	**1**	**0.32**		
Ceratopogoninae	82	26.20	6	PR
Ptychoptera sp.	1	0.32	7	CG
Simulium sp.	2	0.64	6	CF
Euparyphus sp.	2	0.64	5	CG
Total Diptera	**87**	**27.80**		
Cricotopus Bicinctus Gr.	11	3.51	7	CG
Odontomesa sp.	2	0.64	4	CG
Paratendipes sp.	1	0.32	8	CG
Tanytarsus sp.	4	1.28	6	CF
Thienemanniella sp.	2	0.64	6	CG
Total Chironomidae	**20**	**6.39**		
Grand Total	**313**	**100.00**		

Aquatic Macroinvertebrate Summary Data

Site Name: Painted Robe Creek: Lehfeldt site

TOTAL ABUNDANCE	313
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	1
TOTAL NUMBER OF TAXA	20
Number EPT taxa	1

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	9	204	65.18
Odonata	0	0	0.00
Ephemeroptera	0	0	0.00
Plecoptera	0	0	0.00
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	1	1	0.32
Lepidoptera	0	0	0.00
Coleoptera	1	1	0.32
Diptera	4	87	27.80
Chrionomidae	5	20	6.39

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.05

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	1	82	26.20
Parasite	2	178	56.87
Collector-gatherer	13	45	14.38
Collector-filterer	2	6	1.92
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	1	1	0.32
Shredder	1	1	0.32
Xylophage	0	0	0.00
Omnivore	0	0	0.00
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	0.17
Scraper/(Scraper + C.filterer)	0.14
Shredder/Total organisms	0.00

Site ID: PR 1-3

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Nematoda	173	55.27
Ceratopogoninae	82	26.20
Sphaeriidae	14	4.47
Cricotopus Bicinctus Gr.	11	3.51
Acari	5	1.60
SUBTOTAL 5 DOMINANTS	285	91.05
Tubificidae - immature	4	1.28
Tanytarsus sp.	4	1.28
Copepoda	3	0.96
Physella sp.	2	0.64
Simulium sp.	2	0.64
TOTAL DOMINANTS	300	95.85

SAPROBIC INDICES

Hilsenhoff Biotic Index	5.61

DIVERSITY MEASURES

Shannon H (loge)	1.45
Shannon H (log2)	2.09
Evenness	0.48
Simpson D	0.38

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	197	62.94
Univoltine	108	34.50
Semivoltine	8	2.56

	#TAXA	ABUNDANCE	PERCENT
Tolerant	12	8	2.56
Intolerant	0	0	0.00
Clinger	4	18	5.75

Aquatic Macroinvertebrate Taxonomic Data

Site Name:Painted Robe Creek: Road Crossing (Paulson)
Site ID: PR 2-1

Approx. percent of sample used: 17

Taxon	Quantity	Percent	HBI	FFG
Tubificidae - immature	19	6.76	9	CG
Stagnicola sp.	1	0.36	6	CG
Physella sp.	1	0.36	8	CG
Hyalella azteca	6	2.14	8	CG
Total Misc. Taxa	**27**	**9.61**		
Enallagma/Ischnura sp.	1	0.36	9	PR
Total Odonata	**1**	**0.36**		
Caenis sp.	4	1.42	7	CG
Total Ephemeroptera	**4**	**1.42**		
Ambrysus sp.	3	1.07	11	PR
Total Hemiptera	3	**1.07**		
Dytiscidae	3	1.07	5	PR
Dubiraphia sp.	67	23.84	6	CG
Microcylloepus sp.	1	0.36	7	SC
Haliplus sp.	1	0.36	5	MH
Hydrophilidae	6	2.14	5	PR
Total Coleoptera	**78**	**27.76**		
Ceratopogoninae	12	4.27	6	PR
Simulium sp.	19	6.76	6	CF
Caloparyphus sp.	1	0.36	5	CG
Nemotelus sp.	2	0.71	8	CG
Tabanus sp.	2	0.71	5	PR
Total Diptera	**36**	**12.81**		
Brillia sp.	1	0.36	5	SH
Cricotopus sp.	106	37.72	7	CG
Cricotopus Trifascia Gr.	1	0.36	6	CG
Dicrotendipes sp.	1	0.36	8	CG
Micropsectra sp.	8	2.85	7	CG
Orthocladius (Orthocladius) Group	6	2.14	6	CG
Parametriocnemus sp.	3	1.07	5	CG
Paratendipes sp.	1	0.36	8	CG
Tanypus sp.	2	0.71	10	PR
Thienemanniella sp.	3	1.07	6	CG
Total Chironomidae	**132**	**46.98**		
Grand Total	**281**	**100.00**		

Aquatic Macroinvertebrate Summary Data

Site Name:Painted Robe Creek: Road Crossing (Paulson)

Site ID: PR 2-1

TOTAL ABUNDANCE	281
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	4
TOTAL NUMBER OF TAXA	27
Number EPT taxa	1

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	4	27	9.61
Odonata	1	1	0.36
Ephemeroptera	1	4	1.42
Plecoptera	0	0	0.00
Hemiptera	1	3	1.07
Megaloptera	0	0	0.00
Trichoptera	0	0	0.00
Lepidoptera	0	0	0.00
Coleoptera	5	78	27.76
Diptera	5	36	12.81
Chrionomidae	10	132	46.98

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.03

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	7	29	10.32
Parasite	0	0	0.00
Collector-gatherer	16	230	81.85
Collector-filterer	1	19	6.76
Macrophyte-herbivore	1	1	0.36
Piercer-herbivore	0	0	0.00
Scraper	1	1	0.36
Shredder	1	1	0.36
Xylophage	0	0	0.00
Omnivore	0	0	0.00
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	0.05
Scraper/(Scraper + C.filterer)	0.05
Shredder/Total organisms	0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Cricotopus sp.	106	37.72
Dubiraphia sp.	67	23.84
Tubificidae - immature	19	6.76
Simulium sp.	19	6.76
Ceratopogoninae	12	4.27
SUBTOTAL 5 DOMINANTS	223	79.36
Micropsectra sp.	8	2.85
Hyalella azteca	6	2.14
Hydrophilidae	6	2.14
Orthocladius (Orthocladius)	6	2.14
Caenis sp.	4	1.42
TOTAL DOMINANTS	253	90.04

SAPROBIC INDICES

Hilsenhoff Biotic Index	6.74

DIVERSITY MEASURES

Shannon H (loge)	1.76
Shannon H (log2)	2.54
Evenness	0 53
Simpson D	0.18

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	99	35.23
Univoltine	104	37.01
Semivoltine	78	27.76

	#TAXA	ABUNDANCE	PERCENT
Tolerant	12	93	33.10
Intolerant	0	0	0.00
Clinger	5	194	69.04

Aquatic Macroinvertebrate Summary Data

Site Name: Painted Robe Creek: at Buffalo Highway Crossing

Site ID: PR 2-3

TOTAL ABUNDANCE	272
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	27
TOTAL NUMBER OF TAXA	24
Number EPT taxa	1

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	3	12	4.41
Odonata	3	82	30.15
Ephemeroptera	1	27	9.93
Plecoptera	0	0	0.00
Hemiptera	2	11	4.04
Megaloptera	0	0	0.00
Trichoptera	0	0	0.00
Lepidoptera	0	0	0.00
Coleoptera	5	16	5.88
Diptera	2	16	5.88
Chrionomidae	8	108	39.71

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.25

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	9	113	41.54
Parasite	1	2	0.74
Collector-gatherer	10	145	53.31
Collector-filterer	0	0	0.00
Macrophyte-herbivore	1	4	1.47
Piercer-herbivore	0	0	0.00
Scraper	0	0	0.00
Shredder	1	1	0.37
Xylophage	0	0	0.00
Omnivore	1	1	0.37
Unknown	1	6	2.21

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	#DIV/0!
Scraper/(Scraper + C.filterer)	#DIV/0!
Shredder/Total organisms	0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Enallagma/Ischnura sp.	77	28.31
Cladotanytarsus sp.	39	14.34
Dicrotendipes sp.	31	11.40
Chironomus sp.	28	10.29
Caenis sp.	27	9.93
SUBTOTAL 5 DOMINANTS	202	74.26
Ceratopogoninae	15	5.51
Tubificidae - immature	9	3.31
Corixidae	6	2.21
Dytiscidae	6	2.21
Ambrysus sp.	5	1.84
TOTAL DOMINANTS	243	89.34

SAPROBIC INDICES

Hilsenhoff Biotic Index	8.01

DIVERSITY MEASURES

Shannon H (loge)	2.01
Shannon H (log2)	2.90
Evenness	0.63
Simpson D	0.12

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	83	30.51
Univoltine	171	62.87
Semivoltine	18	6.62

	#TAXA	ABUNDANCE	PERCENT
Tolerant	12	109	40.07
Intolerant	0	0	0.00
Clinger	2	4	1.47

Aquatic Macroinvertebrate Taxonomic Data

Site Name: Painted Robe Creek: upstream of the Musselshell River

Site ID: 2-14 Approx. percent of sample used 52

Taxon	Quantity	Percent	HBI	FFG
Tubificidae - immature	8	2.37	9	CG
Physella sp.	34	10.09	8	CG
Cladocera	169	50.15	8	CF
Hyalella azteca	29	8.61	8	CG
Total Misc. Taxa	**240**	**71.22**		
Anax sp.	1	0.30	8	PR
Argia sp	4	1.19	7	PR
Enallagma/Ischnura sp.	25	7.42	9	PR
Total Odonata	**30**	**8.90**		
Centroptilum sp.	5	1.48	2	CG
Total Ephemeroptera	**5**	**1.48**		
Corixidae	3	0.89	8	UN
Ambrysus sp.	3	0.89	11	PR
Total Hemiptera	**6**	**1.78**		
Dytiscidae	4	1.19	5	PR
Total Coleoptera	**4**	**1.19**		
Acalcarella sp.	8	2.37		
Chironomus sp.	1	0.30	10	CG
Cladotanytarsus sp.	12	3.56	7	CG
Corynoneura sp.	1	0.30	7	CG
Cricotopus Bicinctus Gr.	3	0.89	7	CG
Cryptochironomus sp.	1	0.30	8	PR
Dicrotendipes sp.	3	0.89	8	CG
Micropsectra sp.	10	2.97	7	CG
Paratanytarsus sp.	10	2.97	6	UN
Procladius sp.	1	0.30	9	CG
Stilocladius sp.	2	0.59	6	UN
Total Chironomidae	**52**	**15.43**		
Grand Total	**337**	**100.00**		

Aquatic Macroinvertebrate Summary Data

Site Name: Painted Robe Creek: upstream of the Musselshell River

Site ID: PR 2-14

TOTAL ABUNDANCE	337
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	5
TOTAL NUMBER OF TAXA	22
Number EPT taxa	1

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	4	240	71.22
Odonata	3	30	8.90
Ephemeroptera	1	5	1.48
Plecoptera	0	0	0.00
Hemiptera	2	6	1.78
Megaloptera	0	0	0.00
Trichoptera	0	0	0.00
Lepidoptera	0	0	0.00
Coleoptera	1	4	1.19
Diptera	0	0	0.00
Chrionomidae	11	52	15.43

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.10

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	6	38	11.28
Parasite	0	0	0.00
Collector-gatherer	11	107	31.75
Collector-filterer	1	169	50.15
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	0	0	0.00
Shredder	0	0	0.00
Xylophage	0	0	0.00
Omnivore	0	0	0.00
Unknown	3	15	4.45

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	0.00
Scraper/(Scraper + C.filterer)	0.00
Shredder/Total organisms	0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Cladocera	169	50.15
Physella sp.	34	10.09
Hyalella azteca	29	8.61
Enallagma/Ischnura sp.	25	7.42
Cladotanytarsus sp.	12	3.56
SUBTOTAL 5 DOMINANTS	269	79.82
Micropsectra sp.	10	2.97
Paratanytarsus sp.	10	2.97
Tubificidae - immature	8	2.37
Acalcarella sp.	8	2.37
Centroptilum sp.	5	1.48
TOTAL DOMINANTS	310	91.98

SAPROBIC INDICES

Hilsenhoff Biotic Index	7.66

DIVERSITY MEASURES

Shannon H (loge)	1.94
Shannon H (log2)	2.80
Evenness	0.63
Simpson D	0.28

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	212	62.83
Univoltine	120	35.68
Semivoltine	5	1.48

	#TAXA	ABUNDANCE	PERCENT
Tolerant	12	78	23.15
Intolerant	0	0	0.00
Clinger	1	3	0.89